

U. S. DEPARTMENT OF COMMERCE

JESSE H. JONES, Secretary

NATIONAL BUREAU OF STANDARDS

LYMAN J. BRIGGS, Director

**OIL-BURNING FLOOR FURNACES
EQUIPPED WITH VAPORIZING
POT-TYPE BURNERS**

COMMERCIAL STANDARD CS113-44

Effective Date for New Production From February 17, 1944



**A RECORDED VOLUNTARY STANDARD
OF THE TRADE**

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PROMULGATION
of
COMMERCIAL STANDARD CS113-44
for
OIL-BURNING FLOOR FURNACES EQUIPPED
WITH VAPORIZING POT-TYPE BURNERS

On December 8, 1942, at the instance of the Standards Section, Consumer Division, Office of Price Administration, a conference of representative manufacturers of oil-burning floor furnaces equipped with vaporizing pot-type burners adjusted and adopted a proposed commercial standard for this commodity.

The draft was circulated on April 9, 1943, to leading distributors, user organizations, Government agencies, testing laboratories, and to manufacturers for comment. Following adjustment in the light of the comment, a revised draft of the proposed commercial standard was circulated on July 6, 1943, to the entire trade for written acceptance.

Those concerned have since accepted and approved the standard as shown herein for promulgation by the U. S. Department of Commerce, through the National Bureau of Standards.

The standard is effective for new production from February 17, 1944.

Promulgation recommended.

I. J. Fairchild,
Chief, Division of Trade Standards.

Promulgated.

Lyman J. Briggs,
Director, National Bureau of Standards.

Promulgation approved.

Jesse H. Jones,
Secretary of Commerce

OIL-BURNING FLOOR FURNACES EQUIPPED WITH VAPORIZING POT-TYPE BURNERS

COMMERCIAL STANDARD CS113-44

PURPOSE

1. The purpose of this standard is (1) to establish minimum specifications for the guidance of manufacturers, distributors, and users of oil-burning floor furnaces, (2) to avoid delays and misunderstandings, and (3) to provide a uniform basis for guaranteeing compliance through the use of labels or certification.

SCOPE

2. This standard applies to oil-fired, flue-connected floor furnaces equipped with vaporizing pot-type burners with or without mechanical draft or forced circulation, either manually or automatically controlled, and includes the following sections:

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DEFINITIONS

3. *Floor furnace*.—An oil-burning floor furnace is defined as a completely self-contained oil-burning furnace-burner unit, flue-connected, and arranged to be inserted into and suspended from the floor, having integral warm-air discharge and cold-air return, with provisions for control and operation from floor level.

3a. *Vaporizing pot-type oil burner*.—A device for the combustion of fuel oil, consisting of an oil-vaporizing bowl or other receptacle to which the liquid fuel may be fed in controllable quantities, the heat of combustion being used to vaporize the fuel, with provisions for admitting air and mixing it with the oil vapor in combustible proportions.

3b. *Manufacturer*.—For the purpose of this standard, the manufacturer shall be the company or organization which evidences its responsibility to the purchaser by (1) permanently affixing its name,

address, and nationally registered trade-mark or trade name to the furnace; (2) printing its name, address, and nationally registered trade-mark or trade name on the instructions; and (3) by having its name and address listed in the Underwriters' Laboratories, Inc., List of Inspected Appliances.

GENERAL REQUIREMENTS

4. *Safety*.—The furnace shall meet the safety requirements of Underwriters' Laboratories, Inc. Presence on the furnace of the label of Underwriters' Laboratories, Inc. shall be accepted as evidence of compliance with these requirements.

5. *Durability*.—The design and construction of the furnace shall be such as to insure its durability in service, as outlined in the section on "Design and Construction" in this standard.

6. *Dependability*.—The furnace shall be capable of functioning uniformly and reliably when installed and adjusted in accordance with the manufacturer's instructions.

7. *Testing and rating*.—Each model of furnace shall be tested and rated as outlined in this standard. Ratings shall be clearly set forth in the manufacturer's catalog or literature and on the name plate as outlined in the sections on "Publication of Furnace Ratings" and "Informative Labeling," which are a part of this standard.

8. *Over-all efficiency*.—The furnace shall be capable of meeting the minimum efficiency requirements outlined in the section on "Performance" in this standard.

9. *Operating instructions*.—Each furnace shall be accompanied by a complete set of operating instructions, covering essential points with respect to selection of fuel, operation, and upkeep. There also shall be included, either in these instructions or separately, installation instructions outlining the conditions of installation that must be fulfilled in order that successful operation of the unit may be obtained. These installation instructions may at the option of the manufacturer be in sufficient detail so that installation may be made from the instructions.

DESIGN AND CONSTRUCTION

10. *The outer casing*, or jacket, shall be constructed of material of such strength that it is not readily damaged or dented in shipment or use.

11. *Oil burners* shall be of the vaporizing (pot) type constructed of steel, not less than No. 20 gage (see par. 14), or other suitable material of equal resistance to heat, corrosion, and fuel leakage.

12. *Combustion chambers*, radiating drums and/or other surfaces exposed to the direct heat of the burner flame and/or to the products of combustion shall be constructed of sheet steel of not less than No. 20 gage or of other suitable materials of equal resistance to heat and corrosion. The temperature of the metal shall not exceed 1,000° F under conditions of the rating test as specified in paragraphs 23 to 29, inclusive, unless constructed of heat-resisting material suitable for the temperature encountered. Combustion chambers shall be fitted with doors or equivalent means for permitting access to interior surfaces as required for cleaning and servicing.

13. *The flue collar* shall be constructed of a material conforming to that specified in par. 12 for the combustion chamber and shall be rigidly attached at the flue outlet of the heater. It shall afford convenient, suitable means for attaching the smoke pipe securely to the heater.

14. *Sheet-steel gages*.—All sheet-steel gages specified in this standard shall be interpreted as indicated blow:

Manufacturers' standard practice gage number	Thickness (inch)
20	0.0359 \pm mill tolerance.
220299 \pm mill tolerance.
240239 \pm mill tolerance.
260179 \pm mill tolerance.
280149 \pm mill tolerance.

15. *Oil control and lighting*.—Each furnace shall be operable from the floor level.

16. *Finish*.—Metal surfaces of furnace casings, grilles, and accessories shall be adequately protected against rust or corrosion and against damage during manufacture, test, shipment, and reasonable conditions of storage.

17. *Furnace accessories and fittings*.

17a. *The control valve* or other means for oil control shall be accessible for operation and servicing and shall have means for (a) controlling the desired oil flow, (b) indicating the approximate high- and low-fire settings, and (c) restricting the maximum fuel feed rate, which shall not exceed by more than 5 percent the rate used in establishing maximum published rating.

17b. *The constant-level valve*, if used, shall be of the manual reset, float and trip type permitting air escapement, or otherwise be so constructed as to prevent excessive accumulations of oil in the valve. It shall be rigidly mounted on the furnace and supported independently of the piping. All parts shall be made of corrosion-resistant material.

17c. *An automatic draft regulator* shall be furnished with each floor furnace, with adequate instructions for its use.

17d. *Gaskets*, where required for fuel-handling parts, shall be of soft copper, copper asbestos, hard lead, or approved equivalent for screwed joints, and of Underwriters' listed sheet packing or its equivalent for bolted joints.

PERFORMANCE

18. The furnace shall be capable of meeting the following minimum performance requirements when tested as outlined in accordance with the "Laboratory Test Code", which is a part of this standard.

19. *Lighting and warming up burner*.—Adequate provision shall be made to insure ease of lighting and to insure against the burner flame being extinguished after lighting and before the burner has become thoroughly heated.

20. *Operation of burner and controls*.

20a. Controls for fuel and draft shall function easily and reliably.

20b. The burner shall be capable of functioning uniformly and reliably without excessive carbonization or other phenomena which

would impair its safe and proper operation on the grades of fuel recommended by the manufacturer for use therein.

20c. The furnace shall operate dependably and be capable of passing the 6 percent ICHAM (Institute of Cooking and Heating Appliance Manufacturers) smoke test at high-fire operation, and at low-fire setting if permitted by construction.

20d. Thermostatically controlled burners shall be provided with dependable ignition systems. Oil pilots, if used, shall operate cleanly.

21. *Heating capacity.*—The furnace shall be capable of delivering the heat output claimed by the manufacturer when tested as outlined in the "Laboratory Test Code", which is a part of this standard.

22. *Operating efficiency.*—The furnace shall be capable of operating with an over-all efficiency of not less than 70 percent when tested at high-fire operation under the draft recommended by the manufacturer but not to exceed 0.06 in., as outlined in par. 28.

LABORATORY TEST CODE

23. The purpose of this code is to provide a uniform standard method for ascertaining the maximum practical heat output in Btu per hour of flue-connected oil-burning floor furnaces of the type covered by this standard when operating under approximately normal service conditions.

24. *Principle.*

24a. Since no simple and accurate method is known for measuring the heat output of an oil furnace directly, a heat-loss calculation is to be relied upon.

24b. This method is based on the principle that A , the total heat of the fuel used, minus B , the heat lost in the flue gases, equals C , the net heat delivered to the room. Then

$$C/A = E,$$

in which E is the efficiency.

24c. Care must be used in setting up and adjusting the furnace, as well as in selecting, calibrating, and accurately reading the instruments used for rating tests.

25. *Furnace test setup.*

25a. The furnace shall be installed in accordance with the instructions of the manufacturer, in a standard test platform (see fig. 1, A and B) in a room free from drafts, with flue connections, accessories, and draft regulator, as shown in figures 1 and 2 of this standard.

25b. Provision shall be made for the draft recommended by the manufacturer for high-fire operation of the furnace, also for maintaining at least 70° F observed room temperature.

26. *Instruments and their location.*

26a. A calibrated laboratory-type thermometer for taking air temperature shall be located as shown in figure 1, A and B .

26b. A draft gage with an accuracy of ± 0.0025 in. of water column shall be connected as shown in figure 3.

26c. A potentiometer (suggested range 0° to 1,200° F or equal).

26d. A No. 20 gage iron-constantan thermocouple or equivalent thermocouple with holder, as shown in figures 3 and 4.

26e. Gas-analysis apparatus, preferably of the Orsat type capable of determining CO_2 , O_2 , and CO values with an accuracy of $\pm 1/4$ of 1 percent or better.

26f. Suitable means for measuring the flow of oil to the furnace (measurement by weight preferred).

26g. An ICHAM smoke meter (see figs. 5 and 6).

26h. A stop watch (an interval timer for smoke test is also desirable).

27. *Fuel oil.*

27a. *Selection and heating value of fuel oil.*—The fuel used for furnace rating tests shall be of the heaviest grade recommended by the manufacturer and shall be assumed to have a gross heating value as given in the following table:

Gravity	Density	Calorific values ¹	
<i>Degrees API at 60° F</i>	<i>lb/gal</i>	<i>Btu/lb</i>	<i>Btu/gal</i>
30	7.305	19,420	141,800
31	7.260	19,450	141,200
32	7.215	19,490	140,600
33	7.171	19,520	140,000
34	7.128	19,560	139,400
35	7.085	19,590	138,800
36	7.043	19,620	138,200
37	7.001	19,650	137,600
38	6.960	19,680	137,000
39	6.920	19,720	136,400
40	6.879	19,750	135,800
41	6.839	19,780	135,200
42	6.799	19,810	134,700
43	6.760	19,830	134,100
44	6.722	19,860	133,500
45	6.684	19,890	132,900

¹ The above figures are taken from Miscellaneous Publication of the National Bureau of Standards M97 (table 6).

27b. *Correction to standard API gravity at 60° F.* ¹

Observed temperature of oil	Observed gravity (degrees API)				
	30	33	36	39	42
° F					
50	30.7	33.7	36.7	39.8	42.8
60	30.0	33.0	36.0	39.0	42.0
70	29.3	32.3	35.3	38.2	41.2
80	28.7	31.6	34.6	37.5	40.4
90	28.0	30.9	33.8	36.7	39.6
100	27.4	30.3	33.2	36.1	38.9

¹ The above figures are from "National Standard Petroleum Oil Tables", Circular of the National Bureau of Standards C410 (March 4, 1936).

28. *Test procedure.*

28a. The furnace shall be operated under rating-test conditions until equilibrium conditions of room temperature, fuel flow rate, and flue-gas temperature have been established. If floor furnace is equipped with a limit control or other device for reducing the oil input when a predetermined grille air temperature is attained, such limit control or device shall be rendered inoperative during this test.

28b. *Fluctuation of draft.*—The maximum fluctuation in draft from the recorded average during the tests shall not exceed ± 0.005 in. of water column.

28c. *High fire—draft.*—The average draft during the high-fire test shall be that recommended by the manufacturer but in no case less than 0.02 in. nor more than 0.06 in. of water column.

28d. *High fire—fuel feed rate.*—The fuel feed rate shall be slowly increased to the desired rate for high-fire operation, but in no case shall it exceed the rate at which the furnace will pass the smoke test and the unburned-fuel-gases test, nor shall it exceed the average rate secured during the Underwriters' "Safety Test". The fuel feed rate shall then be maintained constant throughout the test. This condition is met if four consecutive fuel readings taken at approximately equal intervals throughout the test period do not vary by more than 5 percent of the largest readings taken.

28e. *High fire—start of smoke test.*—For high-fire operation the smoke test shall begin after equilibrium conditions have been established.

28f. *Low fire—draft.*—When operated at low-fire setting (1) the fire shall not snuff out at the draft recommended by the manufacturer for high-fire operation but not to exceed 0.06 in. of water column; and (2) the smoke test shall be run at a draft of 0.02 in. of water column. The draft regulator shall be free to operate in the low-fire test for snuff out.

28g. *Low fire—fuel feed rate.*—The fuel feed rate for low-fire operation shall be that recommended by the manufacturers, but not in excess of 25 percent of the high-fire-test rate.

28h. *Low fire—start of smoke test.*—For low-fire operation the smoke test shall begin after equilibrium conditions have been established.

28i. *Smoke test.*—The amount of smoke in the flue gas at each rate of fire required for tests shall not exceed that indicated by a 6-percent ICHAM smoke-meter reading on a glass rod after 20 minutes of exposure in the flue pipe at the point indicated in figures 2 and 3.

28j. Unburned fuel gases shall not occur in the flue products in sufficient quantities:

- (1) To be measurable by recognized methods of gas analysis as unburned fuel gas or vapors in excess of 0.2 percent by volume, or
- (2) To result in failure of the observed CO_2 and O_2 values to check at the ultimate by more than 0.3 percent of O_2 on the check chart—figure 7 of this standard.

28k. *Stack temperature and minimum CO_2 for high-fire operation.*—The observed flue-gas temperature at maximum-output rating shall not be less than 300°F nor more than 780°F above room temperature, and the percentage of CO_2 in the stack gases shall be not less than 10. In no case shall the efficiency, as determined from the flue-gas temperature and CO_2 reading, be less than 70 percent as determined by the chart, figure 8, of this standard.

29. *Observations during test.*—After equilibrium conditions have been established, the actual rating test shall be started and continued for at least 1 hour. The following observations shall be made and recorded at the start of the test and at three approximately equal intervals throughout the test:

- (a) Draft in flue pipe.
- (b) Room temperature.
- (c) Rate of flow of oil to heater.
- (d) Flue gas temperature (read immediately before taking flue-gas sample).
- (e) Percentage of CO_2 , O_2 and CO in flue gas.

NOTE.—Flue gases which cannot be absorbed in the CO_2 and O_2 pipettes, but which can be absorbed in the CO pipette of the Orsat, shall be included as CO , and corrected for as shown on the check chart, figure 7, of this standard.

- (f) Smoke motor reading.
- (g) The barometric pressure shall be read at least once during the test.
- (h) The absence of visible red spots on the combustion chamber will be accepted as evidence of compliance with the temperature requirements of paragraph 12.

30. *Calculation of furnace efficiencies, ratings, etc.*—The calculation of results on all combustion data shall be based on figures 7, 8, and 9 (on which allowances have been made for heat losses in the flue gas).

31. *Corrections for altitude.*—The appropriate correction factor from the following table may be used for converting the fuel-oil input rate at the smoke point at higher altitudes to the corresponding fuel-input rate at sea level. (In no case, however, shall the corrected fuel-input rate used for furnace rating purposes exceed the maximum fuel flow rate obtainable at high-fire valve setting with recommended fuels.)

31a. *Altitude-correction factors.*

Approximate altitude ¹	Barometric pressure	Correction factor
<i>ft</i>	<i>in. of mercury</i>	
0	30.0	1.00
500	29.5	1.02
1,000	29.0	1.04
1,500	28.5	1.06
2,000	28.0	1.08
2,500	27.5	1.10
3,000	27.0	1.12
3,500	26.5	1.14
4,000	26.0	1.16
4,500	25.5	1.18
5,000	25.0	1.20
5,500	24.5	1.22
6,000	24.0	1.24
6,500	23.5	1.26
7,000	23.0	1.28

¹ The effective furnace-output rating for regions higher than sea level may be estimated by dividing the rated hourly heat output at sea level by the conversion factor corresponding to the higher altitude indicated above. If provisions are made for assuring correct air supply for high-altitude work in accordance with the above table, this correction in output is not required. Such units as are intended for high-altitude work shall be plainly marked adjacent to the manufacturer's rating name plate with the altitude range for which they are designed.

PUBLICATION OF FURNACE RATINGS

32. No published, listed, or labeled rating shall be based on efficiencies of less than 70 percent. All such ratings shall be determined as outlined above and shall be expressed thus:

Output ----- Btu per hr at ----- draft with CS ----- oil.

INFORMATIVE LABELING

33. The following data shall be permanently affixed to each furnace as evidence of compliance with the provisions of this standard:

Model No. ----- Commercial Standard CS113-44.
Output ----- Btu per hr at ----- draft with CS No. -- oil.
Manufacturer's name and address -----
Underwriters' label requirements, including heaviest grade of oil for which heater is approved.

GUARANTEES

34. The following uniform guarantee or warranty shall accompany each heater or be published in the manufacturer's printed literature or both.

The ----- Company warrants all oil-burning furnaces manufactured or distributed by it and bearing Commercial Standard CS113-44 to be free from defects in material and workmanship. If any part of the equipment herein described and sold by the company proves to be defective in workmanship or material, and if such part is, within 12 months from date of shipment from the company's factory, returned to such factory, transportation charges prepaid, and if the same is found by the company to be defective in workmanship or material, it will be replaced or repaired, free of charges, f. o. b. factory. The company assumes no liability for consequential damages of any kind and the purchaser by acceptance of this equipment will assume all liability for the consequences of its use or misuse by the purchaser, his employees, or others. A defect, in the meaning of this warranty, in any part of said equipment shall not, when such part is capable of being renewed, repaired, or replaced, operate to condemn such equipment. This warranty is expressly in lieu of all other warranties, guarantees, obligations, or liabilities expressed or implied by the company or its representatives.

35. *Installer's certificate.*—The following certificate, supplied by the manufacturer, shall be placed with each individual installation by the installer:

This ----- floor furnace has been installed
(Brand or company name)
in strict compliance with the requirements of Commercial Standard CS113-44, as issued by the National Bureau of Standards of the U. S. Department of Commerce.

(Date)

(Signature of installer)

GENERAL INSTALLATION REQUIREMENTS

36. *Main points.*—In the installation of a floor furnace, there are five main points to consider. These are sizing, placement, venting, fuel connections, and mechanics of installation.

SIZING

37. *Heat loss.*—The heat loss may be based on a formula established by the American Society of Heating & Ventilating Engineers. Base calculations for residences on 70° F inside all the rooms to be heated when outside temperature is at design temperature. For other types of building the inside design temperatures shall be as recommended by the ASHVE Guide. Simplified formulas are generally used by oil floor furnace manufacturers, and the use of any one of these formulas is permissible provided the result is not less than that obtained from the ASHVE current method.

38. *Size.*—After determining the correct heat loss, a pick-up factor of not less than 10 percent shall be added. The minimum size furnace or furnaces can then be selected. When selecting the proper size furnace, the output rating of a furnace or the combined output ratings of the furnaces shall be not less than the computed maximum hourly heat loss, including the pick-up factor.

PLACEMENT

39. *General.*—After selecting the proper size furnace or furnaces, the next important consideration is the placement of the furnace or furnaces. The following are requirements that will serve in properly placing the furnace or furnaces to serve one story.

40. *Distance.*—To meet varying conditions of climate and usage, it is recommended that the furnace be so located that for residences the maximum distance, center to center, between the furnace and any room to be heated by it, measured through intervening openings, should be as short as possible, preferably not to exceed 15 ft.

41. *Doorways.*—The furnace or furnaces shall be so placed that any single path of air circulating to and from the furnace does not pass through more than one doorway and one arch.

42. *Walls and corners.*—With the exception of wall register models, a floor furnace shall not be placed closer than 6 in. to nearest wall, and wall register models shall not be placed closer than 6 in. from a corner.

43. *Drapes.*—The furnace or furnaces shall be so placed that a door, drape, or similar object cannot be nearer than 12 in. to any portion of the register of the furnace.

44. *Bathroom.*—Any dual-wall register furnace installed between bath and adjoining rooms shall not recirculate air from the bathroom.

45. *Exposure.*—In case there is a choice of locations, the furnace shall favor (be nearer) the sides of the house exposed to the prevailing winter winds.

46. *Central location.*—Generally speaking, the more central the location, the better, favoring slightly the sides exposed to the prevailing winter winds.

47. *Floor levels.*—The floor immediately surrounding the floor furnace shall be reasonably level. When heating two rooms having different floor levels, the furnace shall be installed in the room having the lower floor. It is also well to locate the furnace near the steps, if possible. Where a dual-wall register furnace is installed between rooms having different floor levels, the furnace shall be installed at the lower floor level with an approved vertical extension to the upper floor level.

48. *Bracing*.—The floor around the furnace shall be braced and headed with framework of material not lighter than the joists. The inside dimensions of the framework shall be approximately $\frac{1}{2}$ in. longer and wider than the furnace to be installed.

49. *Combustion air*.—Fixed ventilation shall be provided to any confined space which encloses the floor furnace, if combustion air is taken from this space, by means of a duct or grille arranged to supply air from a permanently ventilated attic or under-floor space; the duct or grille to be screened and to have a free area at least twice the free area of the vent collar of the floor furnace and installed in such a manner as to insure proper combustion.

50. *Seepage pan*.—Whenever the excavation for clearance from the ground exceeds 12 in., or water seepage is apparent under the house, a watertight copper pan, concrete pit, or watertight barrier of other suitable material shall be used. A copper pan shall be made of not less than 16 oz./sq. ft. sheet copper. The pan shall be anchored in place, and the walls shall extend at least 4 in. above the ground level, with 12-in. clearance from furnace casing on all sides, except the control side, which shall have 18-in. clearance.

51. *Access*.—Adequate provision shall be made for easy access to the furnace under the house by means of an opening in the foundation wall or through a trap door of at least 18 by 24 in., located at some convenient point in the house, and a clear and unobstructed passageway to the furnace at least 18 in. high by 24 in. wide.

52. *Appliance alterations*.—All floor furnaces, including those having single or dual-wall register outlets, shall be installed as approved under this standard without alterations, extensions, or changes of any kind in the furnace.

VENTING

53. *General*.—Each floor furnace shall be properly vented to the outer air. Paragraphs 54 to 61 are requirements covering the proper venting of a floor furnace:

54. *Draft regulator*.—A draft regulator which meets the approval requirements of Underwriters' Laboratories, Inc., shall be made a part of the vent connection to the vertical chimney or vent.

55. *Damper*.—A damper or similar device shall never be installed in the vent pipe from a floor furnace.

56. *Size of vent*.—All floor furnaces shall be vented into a vertical vent, flue, or chimney of a size not less than the vent collar of the floor furnace, and in no case less than the equivalent area of a 6-in. diameter. It is recommended that the smallest dimension of the chimney be at least 6 in.

57. *Height*.—The vertical vent, flue, or chimney shall extend at least 2 ft. above the peak of the roof or of any surrounding walls or obstructions liable to cause down draft. The flue shall be provided with an effective anti-down-draft top, where down drafts are liable to occur due to nearby trees or buildings extending above the elevation of the chimney top.

58. *Venting material*.—In case venting material (not a chimney) is used for the vertical vent, the material used shall conform to the local building code. In addition, it shall be installed according to the local building code. In the absence of a local building code, the vent shall consist of approved fireproof material. All masonry chimneys con-

structed for the purpose of venting a floor furnace shall be lined with a terra cotta or comparable flue lining. Whenever a floor furnace is vented into an existing unlined masonry chimney, the chimney shall be clean and tight. The horizontal vent connection in all cases shall enter the chimney at least 1 foot above the bottom of the chimney. Means shall be provided for cleaning out the base of the chimney. In the absence of an automatically operated furnace, it is recommended that it be connected to an individual flue.

59. *Horizontal vent connection.*—The horizontal vent connection shall be as short as practicable and shall not be longer than 50 percent of the height of the vertical vent, flue, or chimney for natural draft furnaces or 75 percent for mechanical draft furnaces. It shall not exceed 10 ft. in length and shall have an upward slope from the furnace of not less than $\frac{1}{4}$ in. per ft. of length. The horizontal vent connection shall not project into the free area of the flue or chimney.

60. *Cross-over or offset.*—No cross-over or offset shall be permitted at an angle of less than 30 degrees to the horizontal.

61. *Holes.*—Both vertical vent and horizontal vent connection shall be clear and free from any stoppage and free from any holes that would restrict draft.

OIL-BURNING FLOOR FURNACE RATING TEST—DATA AND
REPORT SHEET

Manufacturer's Test No.

Floor furnace
 Fuel used for test
 Date of test
 Make Model, type, or No.
 CS12-40 Grade
 Number and size of burners
 API gravity at 60° F
 Tested by

Test data	Readings at equal intervals				Average
1. Draft..... (in. water).....					
2. Room temperature..... (°F).....					
3. Smoke-meter readings..... (%).....					
4. Fuel-temperature readings..... (°F).....					
5. Time intervals used for readings..... (min).....	20	20	20	20	20
6. Fuel-input readings..... (lb).....					
7. Fuel-oil input rate..... (lb/hr, avg).....					
8. Barometric pressure..... (in. mercury).....					
9. Factor to correct fuel-oil input to sea level (see par. 31a).....					
10. Gross heating value of oil..... (Btu/lb).....					
11. Fuel-oil input corrected to sea level or to max fuel-flow rate, whichever is less..... (lb/hr, avg).....					
12. Gross heat input corrected to sea level or to max fuel-flow rate, whichever is less..... (Btu/hr).....					
13. Flue-gas temperature..... (°F).....					
14. Flue-gas temperature rise above room temperature..... (°F).....					
15. CO ₂ in dry flue gas..... (%).....					
16. O ₂ in dry flue gas..... (%).....					
17. Unburned gases expressed as CO..... (%).....					
18. Efficiency for complete combustion (from chart, fig. 8 or 9)..... (%).....					

READINGS AT EQUAL INTERVALS

19. Heat losses due to incomplete combustion (from formula fig. 7)..... (%).....	Average
20. Over-all heater efficiency equals (item 18 minus item 19)..... (%).....	
21. Heat output to room equals item 12 times item 20 (Btu/hr, avg).....	
22. Fuel-input rate for low-fire smoke test (par. 28g)..... (lb).....	
23. Low-fire smoke-meter readings at 20-min intervals..... (%).....	
24. Low-fire snuff-out test at 0.06 in. draft.....	

We hereby certify that the above is a true and accurate copy of the data obtained when the above furnace was tested in strict accordance with section 28 of "Oil-Burning Floor Furnaces Equipped With Vaporizing Pot-Type Burners," Commercial Standard CS113-44.

For
 Address
 By

 (Date)

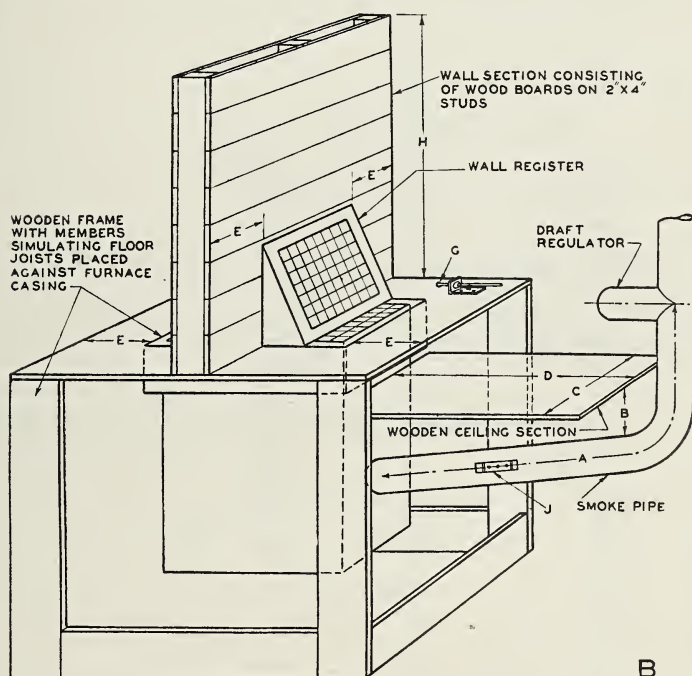
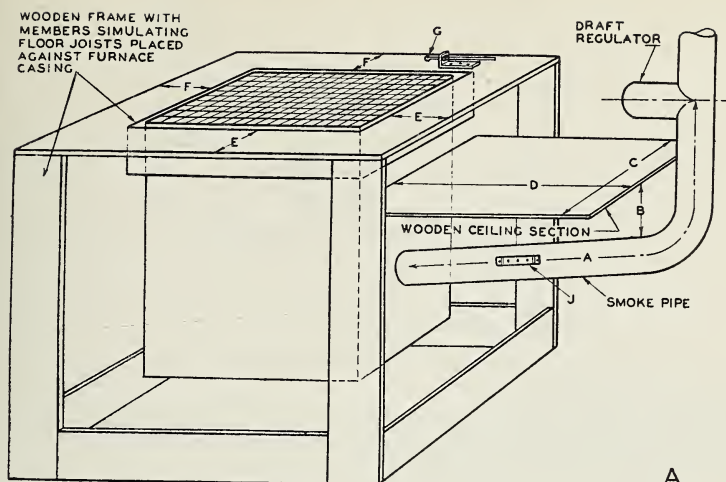


FIGURE 1.—Test set-ups for floor furnaces.

A, Test set-up for floor-register type floor furnaces: A, Minimum of 6 ft of smoke pipe between furnace and draft regulator; B, 9 in.; C, smoke-pipe diameter, plus 2 ft (minimum); D, $3\frac{1}{2}$ ft minimum; E, 1 ft minimum; F, minimum spacing recommended by manufacturer; G, thermometer, placed 6 in. from outside of register adjacent to cold-air return and 1 in. above register level; J, support bracket (see fig. 3).

B, Test set-up for wall-register type floor furnaces: A, Minimum of 6 ft of smoke pipe between furnace and draft regulator; B, 9 in.; C, smoke-pipe diameter, plus 2 ft (minimum); D, $3\frac{1}{2}$ ft minimum; E, 1 ft minimum; G, thermometer, placed 6 in. from outside of register adjacent to cold-air return and 1 in. above register level; H, 4 ft minimum; J, support bracket (see fig. 3).

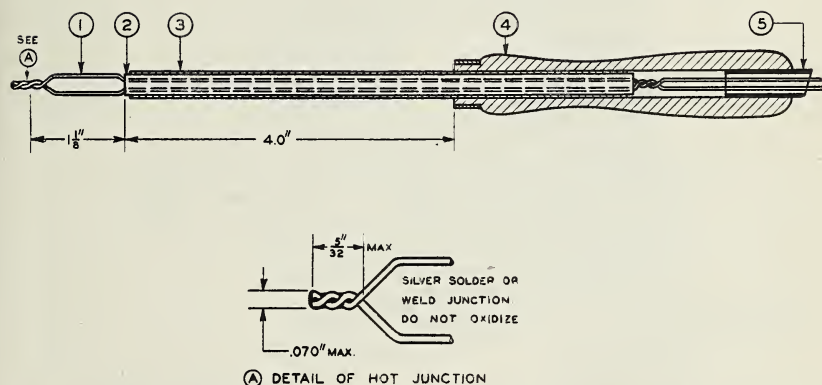


FIGURE 4.—Standard thermocouple for flue-gas temperature measurement.

1, Ten-foot No. 20 B&S gage iron-constantan asbestos or woven glass covered thermocouple wires extending from hot junction to potentiometer or reference junction; 2, Leeds & Northrup standard 714B, or equal, 1/4-in. O. D. 2-hole porcelain insulator, cut 6.0 in. long and ends beveled on two sides; 3, 5/16-in. O. D. by 0.032-in. wall half-hard yellow-brass tubing cut 5 7/8-in. long. Ream, if necessary, to fit over insulator; then crimp ends over beveled ends of insulator; 4, small wooden handle; 5, piece of rubber tubing, 3/16 by 3/32 by 2 in. long. Detail of hot junction: Silver solder or weld junction. Do not oxidize.

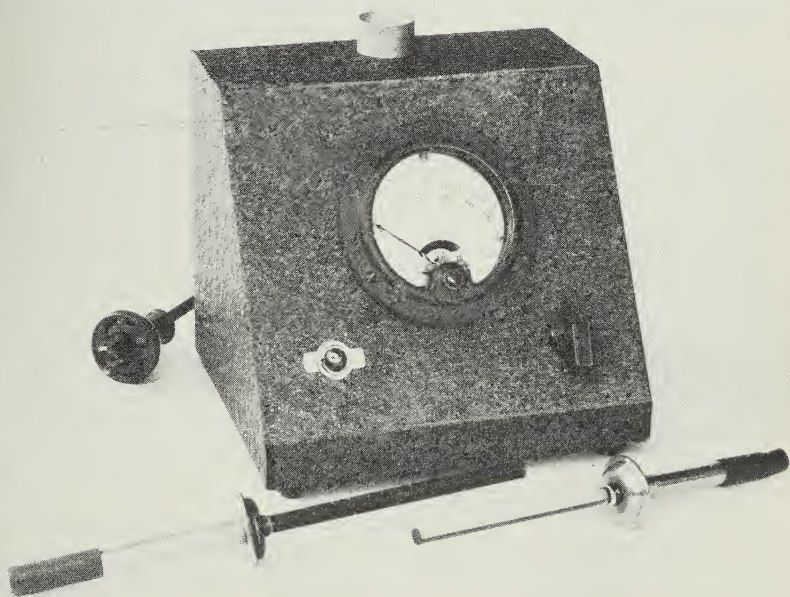


FIGURE 6.—*ICHAM smoke meter.*

Principle of operation.—The smoke meter shown is better described as a photoelectric soot-density comparator. Its operation and use are based on the principles that:

1. A Pyrex-glass rod placed across a stream of flue gas containing oil smoke will collect a deposit of soot on the surface of the rod.
2. Under specified exposure conditions, the amount or depth of soot deposit on the glass rod will be a function of the smoke density, or the proportion of smoke in the flue products.
3. The depth or amount of this smoke deposit can be measured or evaluated in terms of the extent to which it will interfere with the passage of a beam of light through the glass rod onto a photoelectric cell.

Description.—The meter consists of means for supporting a glass or metal rod and means for passing a beam of light through the glass rod onto a photoelectric cell connected to an electric meter. A constant-voltage transformer should be used if line voltage fluctuates objectionably. The over-all size of the meter is approximately $5\frac{1}{2}$ by $5\frac{1}{2}$ by $6\frac{1}{2}$ in. Weight approximately 4 lb without transformer.

Operation.—The meter is adjusted for a "zero" reading with a dull-black opaque rod and for a 100 reading with a clean glass rod. The glass rod is then exposed to the smoke in the flue pipe and placed in the meter to give a reduced meter reading (percentage of light transmitted).

For further information regarding the ICHAM smoke meter write to the Institute of Cooking & Heating Appliance Manufacturers, Shoreham Hotel, Washington, D. C.

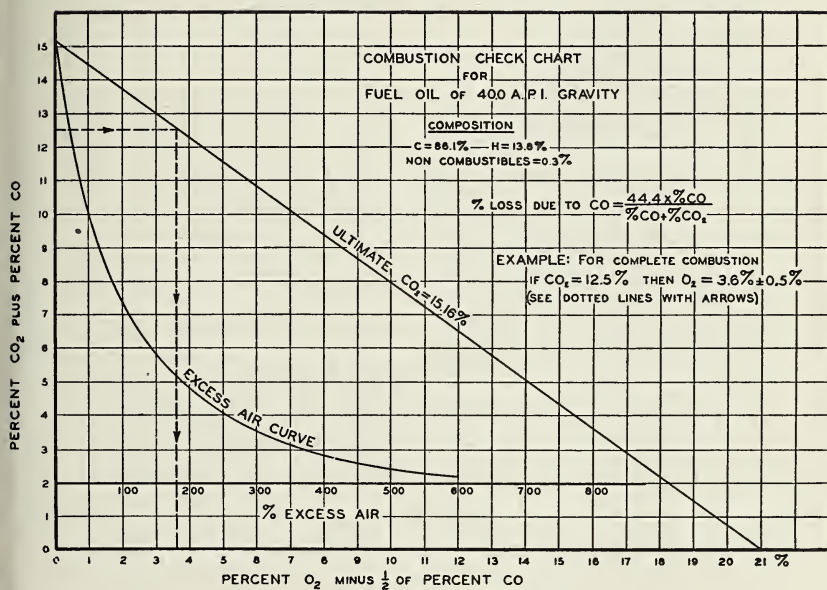


FIGURE 7.—Combustion check chart.

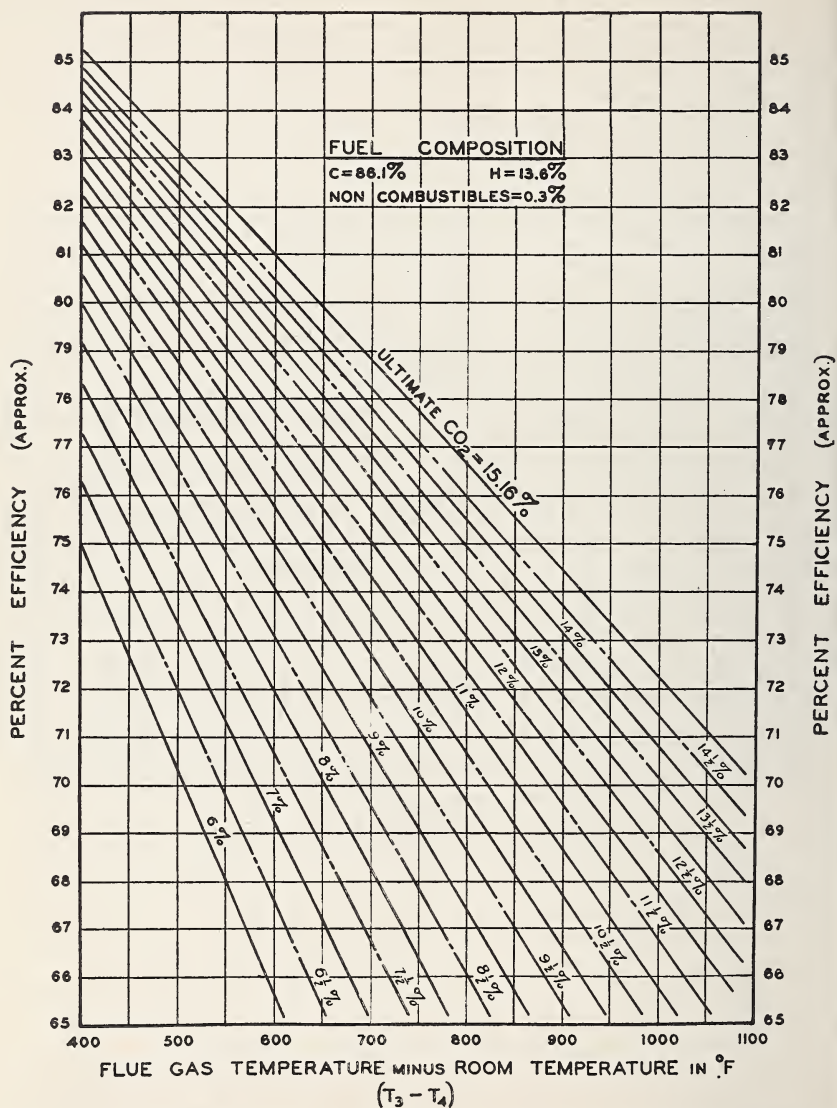


FIGURE 8.—Enlarged efficiency chart for furnaces equipped with vaporizing pot-type burners.

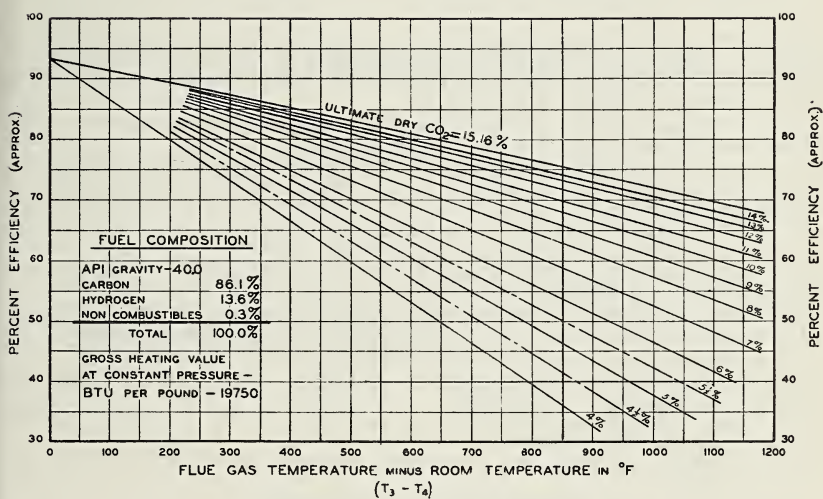


FIGURE 9.—Efficiency chart for furnaces equipped with vaporizing pot-type burners

EFFECTIVE DATE

62. The standard is effective for new production from February 17, 1944.

STANDING COMMITTEE

The following individuals comprise the membership of the standing committee, which is to review, prior to circulation for acceptance, revisions proposed to keep the standard abreast of progress. Each organization nominated its own representative. Comment concerning the standard and suggestions for revision may be addressed to any member of the committee or to the Division of Trade Standards, National Bureau of Standards, which acts as secretary for the committee.

STANLEY PERRY (chairman), Oil Devices, 341 East Ohio Street, Chicago 11, Ill.
 J. C. HEMINGWAY, H. C. Little Burner Co., Inc., San Rafael, Calif.
 GEORGE M. SCHUEDER, Evanoil Division, Evans Products Co., Detroit 27, Mich.
 A. D. OLDS, The Coleman Lamp & Stove Co., Wichita 1, Kans.
 SID J. HEIMAN, International Oil Burner Co., Inc., 3800 Park Avenue, St. Louis 10, Mo.
 SAM ZUERCHER, Yungmeyer Hardware Co., 518 East Douglas Avenue, Wichita, Kans. (representing Western Retail Implement & Hardware Association).
 J. W. ESOCK, Plumbing & Heating Department, Sears, Roebuck & Co., Homan and Arthington Streets, Chicago 7, Ill.
 T. W. McAllister, 1020 Grant Building, Atlanta 3, Ga. (representing Southern Hardware Jobbers Association).
 MONTGOMERY WARD & Co., Chicago, Ill. (invited to name a representative).
 DON SUTHERLAND, T. D. Farrington & Co., 95 Connecticut Street, Seattle 4, Wash.
 MILLARD W. MERRILL, United States Metals Refining Co., Carteret, N. J. (representing National Association of Purchasing Agents).
 MRS. CHARLOTTE PAYNE, 501 Madison Avenue, New York 22, N. Y. (representing National Council of Women).
 R. K. THULMAN, Federal Housing Administration, Washington 25, D. C.
 J. H. WITTE, Underwriters' Laboratories, 207 East Ohio Street, Chicago 11, Ill.
 P. R. ACHENBACH, National Bureau of Standards, Washington 25, D. C.
 LEONARD ASHEIM, 211 State Street, Bridgeport, Conn. (representing The American Institute of Architects).
 E. G. DARBO, 6922 West Wells Street, Wauwatosa 13, Wis. (representing Consumer Co-Operative Builders).
 WM. T. MILLER, Heating & Ventilating Department, Purdue University, Lafayette, Ind.

HISTORY OF PROJECT

Pursuant to a request dated February 19, 1942, from the Standards Section, Consumer Division, Office of Price Administration, there was developed by the interested manufacturers in cooperation with the National Bureau of Standards an entirely new proposed commercial standard for oil-burning floor furnaces. The draft as sponsored by one of the leading companies was reviewed in detail by a conference of interested manufacturers in Chicago, Illinois, on December 8, 1942, and adjusted as a result of written comment.

On April 9, 1943, a revised draft was circulated to leading distributors, testing laboratories, Government agencies and other users, for comment.

On July 6 a draft, revised in the light of this comment, was circulated to the entire trade for written acceptance, as there appeared to be no objections requiring adjustment at a general conference.

Following acceptance by a satisfactory majority, in the absence of active opposition, an announcement was issued on October 20, 1943, that the standard had been accepted as the recorded voluntary standard of the trade effective for new production from February 17, 1944.

ACCEPTANCE OF COMMERCIAL STANDARD

If acceptance has not previously been filed, this sheet properly filled in, signed and returned, will provide for the recording of your organization as an acceptor of this commercial standard.

Date_____

Division of Trade Standards,
National Bureau of Standards,
Washington, D. C.

Gentlemen:

Having considered the statements on the reverse side of this sheet, we accept the Commercial Standard CS113-44 as our standard of practice in the

Production ¹ Distribution ¹ Use ¹ Testing ¹

of oil-burning floor furnaces equipped with vaporizing pot-type oil burners.

We will assist in securing its general recognition and use, and will cooperate with the standing committee to effect revisions of the standard when necessary.

Signature of individual officer_____

(In ink)

(Kindly typewrite or print the following lines)

Name and title of above officer_____

Organization_____

(Fill in exactly as it should be listed)

Street address_____

City and State_____

¹ Please designate which group you represent by drawing lines through the other three. Please file separate acceptances for all subsidiary companies and affiliates which should be listed separately as acceptors. In the case of related interests, trade papers, colleges, etc., desiring to record their general approval, the words "in principle" should be added after the signature.

TO THE ACCEPTOR

The following statements answer the usual questions arising in connection with the acceptance and its significance:

1. *Enforcement.*—Commercial standards are commodity specifications voluntarily established by mutual consent of those concerned. They present a common basis of understanding between the producer, distributor, and consumer and should not be confused with any plan of governmental regulation or control. The United States Department of Commerce has no regulatory power in the enforcement of their provisions, but since they represent the will of the interested groups as a whole, their provisions through usage soon become established as trade customs, and are made effective through incorporation into sales contracts by means of labels, invoices and the like.

2. *The acceptor's responsibility.*—The purpose of commercial standards is to establish for specific commodities, nationally recognized grades or consumer criteria and the benefits therefrom will be measurable in direct proportion to their general recognition and actual use. Instances will occur when it may be necessary to deviate from the standard and the signing of an acceptance does not preclude such departures; however, such signature indicates an intention to follow the commercial standard where practicable, in the production, distribution, or consumption of the article in question.

3. *The Department's responsibility.*—The major function performed by the Department of Commerce in the voluntary establishment of commercial standards on a Nation-wide basis is fourfold: first, to act as an unbiased coordinator to bring all interested parties together for the mutually satisfactory adjustment of trade standards; second, to supply such assistance and advice as past experience with similar programs may suggest; third, to canvass and record the extent of acceptance and adherence to the standard on the part of producers, distributors, and users; and fourth, after acceptance, to publish and promulgate the standard for the information and guidance of buyers and sellers of the commodity.

4. *Announcement and promulgation.*—When the standard has been endorsed by a satisfactory majority of production or consumption in the absence of active, valid opposition, the success of the project is announced. If, however, in the opinion of the standing committee or the Department of Commerce, the support of any standard is inadequate, the right is reserved to withhold promulgation and publication.

ACCEPTORS

The organizations and individuals listed below have accepted this standard as their standard of practice in the production, distribution and use of oil-burning floor furnaces equipped with vaporizing pot-type burners. Such endorsement does not signify that they may not find it necessary to deviate from the standard, nor that producers so listed guarantee all of their products in this field to conform with the requirements of this standard. Therefore specific evidence of conformity should be obtained where required.

ASSOCIATIONS

American Association of Engineers, Chicago, Ill.
American Specification Institute, Chicago, Ill.
Fuel Oil Distributors Association of New Jersey,
Newark, N. J.
National Association of Purchasing Agents, New
York, N. Y.
National Council of Women of the United States,
New York, N. Y. (In principle.)
Producers' Council, Inc., The, Washington, D. C.
(In principle.)
Southern Hardware Jobbers Association, Atlanta,
Ga.

FIRMS

Airstream Engineering Co., Los Angeles, Calif.
Allied Heating & Air Conditioning Co., Lawndale,
Calif.
American Gas Machine Co., Albert Lea, Minn.
American Hardware Supply Co., Pittsburgh, Pa.
American Houses, Inc., New York, N. Y.
American Radiator & Standard Sanitary Corpora-
tion, Pittsburgh, Pa.
Arrow Petroleum Co., Forest Park, Ill.
Baltimore, City of, Bureau of Plans & Surveys,
Baltimore, Md.
Bayley Heating Supply Co., Milwaukee, Wis.
Best Plumbing & Heating Supply Co., E., Quincy,
Ill.
Borg-Warner Corporation, Norge Heating & Con-
ditioning Division, Detroit, Mich.
Case School of Applied Science, Cleveland, Ohio.
Central Co-Operative Wholesale, Superior, Wis.
Chaney Hardware Co., Montpelier, Ind.
Cleveland, City of, Department of Public Safety,
Division of Building, Cleveland, Ohio.
Cole Hot Blast Manufacturing Co., Chicago, Ill.
Coleman Lamp & Stove Co., The, Wichita, Kans.
Colladay Hardware Co., The Frank, Hutchinson,
Kans.
Consumer Co-Operative Builders, Wauwatosa, Wis.
Consumers Heating Equipment Co., Inc., Balti-
more, Md.
Consumers Petroleum Co., Chicago, Ill. (In prin-
ciple.)
Conwell & Co., E. L., Philadelphia, Pa.
Corriveaux, F., Home & Industrial Service, Schen-
ectady, N. Y.
Dallman Supply Co., Sacramento, Calif.
Detroit Lubricator Co., Detroit, Mich. (In prin-
ciple.)
Detroit Testing Laboratory, The, Detroit, Mich.
(In principle.)
Eaton & Morse, Inc., Boston, Mass.
Electrical Testing Laboratories, Inc., New York,
N. Y.
Ernst Hardware Co., Seattle, Wash.
Evans Products Co., Detroit, Mich.
Farrington Co., T. D., Seattle, Wash.
Fletcher-Thompson, Inc., Bridgeport, Conn.
Froehling & Robertson, Inc., Richmond, Va.
Hanks, Inc., Abbot A., San Francisco, Calif.
Henkle & Joyce Hardware Co., Lincoln, Nebr.
Herlan-Patterson, Inc., Buffalo, N. Y.
Higginbotham Pearlstone Hardware Co., Dallas,
Tex.
Holly Heating & Manufacturing Co., S. Pasadena,
Calif.
Home Fuel Oil Co., Passaic, N. J.
Hospital Bureau of Standards & Supplies, Inc.,
New York, N. Y.

Hoyt Heater Co., Los Angeles, Calif.
Hunt Co., Robert W., Chicago, Ill.
Integrity Supply, Inc., New York, N. Y.
International Oil Burner Co., St. Louis, Mo.
Kresky Manufacturing Co., Petaluma, Calif.
Little Burner Co., Inc., H. C., San Rafael, Calif.
Little Products Co., H. C., Aurora, Ill.
Lonergan Manufacturing Co., Albion, Mich.
Lukens Steel Co., Coatesville, Pa.
Marshall-Wells Co., Duluth, Minn.
Master Plumber & Heating Contractor Magazine,
The, Brooklyn, N. Y.
McMahill Heating Service, Omaha, Nebr.
Mellish & Murray Co., Chicago, Ill.
Midland Cooperative Wholesale, Minneapolis,
Minn.
Minnesota Testing Laboratories, Inc., Duluth,
Minn.
Minnesota, University of, Minneapolis, Minn.
Morrison Steel Products, Inc., Buffalo, N. Y.
Motor Wheel Corporation, Duo-Therm Division,
Lansing, Mich. (In principle.)
Nebraska, University of, Lincoln, Nebr.
New Orleans, Inc., Better Business Bureau of
New Orleans, La. (In principle.)
Newark College of Engineering, Newark, N. J.
Northern Controlled Heat Co., Inc., Watertown,
N. Y.
O'Hair & Co., P. E., San Francisco, Calif.
Oil Devices, Chicago, Ill.
Payne Furnace & Supply Co., Inc., Beverly Hills,
Calif.
Pure Oil Co., The, Chicago, Ill.
Quincy Oil Co., The, Quincy, Mass.
Rearick Bros. Automatic Heating, Gary, Ind.
Richmond Hardware Co., Richmond, Va.
Sacramento, Better Business Bureau of, Sacramento,
Calif. (In principle.)
Schuylkill Valley Oil Co., Pottstown, Pa.
Scranton Better Business Bureau, Scranton, Pa.
(In principle.)
Sears, Roebuck & Co., Chicago, Ill.
Southern Equipment & Supply Co., San Diego,
Calif.
Strevell Paterson Hardware Co., Salt Lake City,
Utah.
Sunland Refining Corporation, Heating Department
Fresno, Calif.
Swarthmore Heating Service, Swarthmore, Pa.
Trinner's Sales & Service, Aberdeen, Wash.
Twining Laboratories, The, Fresno, Calif.
Underwriters' Laboratories, Inc., Chicago, Ill.
Walker Manufacturing & Sales Corporation, St.
Joseph, Mo. (In principle.)
Williamson Heater Co., Cincinnati, Ohio.
Zahniser & Warren, Spokane, Wash.

U. S. GOVERNMENT

Agriculture, U. S. Department of, Bureau of P. I. S.
& A. E., Beltsville, Md.
Federal Works Agency, Public Buildings Adminis-
tration, Washington, D. C. (In principle.)
Interior, U. S. Department of, Office of Indian
Affairs, Construction Division, Chicago, Ill.
National Housing Agency, Federal Housing Admin-
istration, Washington, D. C.
Navy Department, Bureau of Yards & Docks,
Washington, D. C.
War Department, Washington, D. C.

